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EDMONTON
EMERY JAMIESON LLP
1700 Oxford Tower
10235 - 101 Street
Edmonton, Alberta
Canada T5J 3G1

Phone: (780) 426-5220
Fax: (780) 420-6277

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Serial No.:	**10/769,761**
Assignee/Applicant:	Halliburton Energy Services, Inc.
Inventor:	Edward James Cargill
Filing Date:	February 3, 2004
Priority Date:	May 2, 2000
Title:	SEAL ASSEMBLY FOR LIMITING THE MOVEMENT OF A SEAL WITHIN A SEAL HOUSING
Group Art Unit:	3673
Confirmation No.:	8914
Examiner:	Alison K. Pickard
Entity Status:	Large Entity
Our Docket:	16463-95 (was 58029-13C)

Transmission of:

1. A Transmittal Letter, in duplicate, for the document indicated below, along with an authorization to charge the sum of **$500.00** as required pursuant to 37 CFR 41.20(b)(2), and any and all additional necessary or required fees in connection with the filing of the Appellant's Brief, to our Deposit Account No. **500748** in the name of Emery Jamieson LLP.; and
2. Appellant's Brief pursuant to 37 C.F.R. 41.37 and further to the Notice of Appeal filed with respect to this U.S. Application on September 1, 2006.

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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE HONORABLE BOARD OF PATENT APPEALS

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Our Docket:	58029-13C (now 16463-95)

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On November 1, 2006

Terrence N. Kuharchuk
Applicant's Agent

TO: **Mail Stop Appeal Brief - Patents**
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL LETTER

Sir:

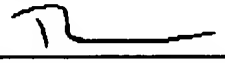
Attached hereto and transmitted herewith for filing are the following:

1. Appellant's Brief pursuant to 37 C.F.R. 41.37 and further to the Notice of Appeal filed with respect to this U.S. Application on September 1, 2006;

2. An authorization to charge the sum of **$500.00** as required pursuant to 37 CFR 41.20(b)(2), and any and all additional necessary or required fees in connection

with the filing of this Appellant's Brief, to our Deposit Account No. **500748** in the name of Emery Jamieson LLP.

Respectfully submitted,
EMERY JAMIESON LLP



Terrence N. Kuharchuk
Reg. No. 34,999
Applicants' Agent

Emery Jamieson LLP
1700 Oxford Tower
10235 - 101 Street
Edmonton, Alberta
Canada T5J 3G1
Phone: (780) 426-5220
Fax: (780) 420-6277

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Alexandria, VA 22313-1450

APPELLANT'S BRIEF UNDER 37 C.F.R. 41.37

Sir:

This Appellant's Brief is further to the Notice of Appeal filed on September 1, 2006.

Please charge the fees in the sum of $500.00 required pursuant to 37 CFR 41.20(b)(2), or any additional required fees in connection with the filing of this Appellant's Brief, to our Deposit Account No. **500748** in the name of Emery Jamieson LLP. POLITE1 00000024 500748 10769761

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1. REAL PARTY IN INTEREST

The real party in interest is the assignee of record, i.e. Halliburton Energy Services, Inc.

2. RELATED APPEALS AND INTERFERENCES (i.e. RELATED PROCEEDINGS)

There are no prior and pending appeals, interferences or judicial proceedings known to the Appellant or the Appellant's legal representative which may be related to, directly affect or be directly affected by or having a bearing on the Board's decision in this Appeal.

3. STATUS OF CLAIMS

Claims 1-20 are currently pending in this Application. All of Claims 1-20 were rejected in the Final Office Action dated April 4, 2006. This Appeal is directed at all of Claims 1-20.

4. STATUS OF AMENDMENTS

No amendments have been made to the Claims since the issuance of the Final Office Action dated April 4, 2006.

5. SUMMARY OF CLAIMED SUBJECT MATTER

Claim 1 is an independent claim. Claims 2-20 all depend directly or indirectly from independent Claim 1. References to the Specification in this Appellant's Brief are references to the Specification "as filed" by the Applicant.

Claims 1-20 are all directed at improvements in a seal assembly (20) of the type for providing a seal with a rotatable component such as a rotatable shaft (28) (page 8, lines 11-14 of the Specification).

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The seal assembly (20) defines a first side (30) and a second side (32) and the rotatable component (28) extends through the seal assembly (20) between the first side (30) and the second side (32) (page 8, lines 21-27 of the Specification). The rotatable component (28) defines a longitudinal axis of rotation (page 5, lines 20-22 of the Specification).

The seal assembly (20) comprises a seal element (22) retained in a seal housing (24) (page 4, lines 1-2 of the Specification). One of the seal element (22) and the seal housing (24) is comprised of a compressible material (page 4, lines 2-3 of the Specification). The seal element (22) is comprised of a planar seal engagement surface (34) (page 4, lines 3-4 of the Specification; Figures 1-3). The seal housing (24) is comprised of a planar housing engagement surface (38) for engaging the planar seal engagement surface (34) (page 4, lines 4-5; Figures 1-3).

The seal assembly (20) is a contacting type seal assembly (20) in which the seal element (22) contacts the rotatable component (28) in order to perform its sealing function (page 1, line 12 to page 2, line 12 of the Specification).

A seal element (22) in a seal assembly (20) of the type described above is typically subjected to a differential pressure across the seal element (22) between the first side (30) of the seal assembly (20) and the second side (32) of the seal assembly (20). The combined effects of this pressure differential and rotation of the rotatable component (28) results in forces being applied to the seal element (22) which may tend to move or distort the seal element (22) (page 14, lines 25-28 of the Specification). Movement and/or distortion of the seal element (22) may result in leakage of fluid between the first side (30) and the second side (32) of the seal assembly (20) and thus failure of the seal assembly (20) (page 1, lines 12-17 of the Specification).

As one example, the pressure differential between the first side (30) and the second side (32) of the seal assembly (20) may cause the seal element (22) to be "lifted" out of the seal housing (24) by fluid which passes under pressure between the seal element (22) and the seal housing (24) (page 1, lines 19-25 of the Specification).

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As a second example, the rotation of the rotatable component (28) may cause the seal element (22) to twist or rotate within the seal housing (24) due to friction between the seal element (22) and the rotatable component (28) (page 2, lines 10-12 of the Specification). This in turn may cause distortion of the seal element (22) and leakage of fluid between the first side (30) and the second side (32) of the seal assembly (20), either between the seal element (22) and the rotatable component (28) or between the seal element (22) and the seal housing (24).

The present invention is directed at improvements in a seal assembly (20) of the type described above which relate to controlling movement of the seal element (22) relative to the seal housing (24) by providing an engagement force between the engagement surfaces (34,38).

Claim 1.

The improvement as claimed in independent Claim 1 is directed at an improvement in a seal assembly (20) of the type described above, which improvement includes:

(a) providing that one of the planar seal engagement surface (34) and the planar housing engagement surface (38) is comprised of a compressible material;

(b) providing that the other of the planar seal engagement surface (34) and the planar housing engagement surface (38) defines a depression (42) therein for providing an isolated gap (48) between the planar seal engagement surface (34) and the planar housing engagement surface (38); and

(c) providing that the other of the planar seal engagement surface (34) and the planar housing engagement surface (38) (and thus both the planar seal engagement surface (34) and the planar housing engagement surface(38)) is oriented in a plane normal to the longitudinal axis of the rotatable component (28).

As expressly provided for in independent Claim 1, the effect of the above configuration is that when the seal element (22) is exposed to a fluid pressure on the second side (32) of the seal assembly (20), an engagement force is exerted between the planar seal engagement

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surface (34) and the planar housing engagement surface (38), pressing the compressible material into the depression (42) and thereby restraining movement of the seal element (22) relative to the seal housing (24).

Claim 2.

Dependent Claim 2 provides a further improvement in a seal assembly (20) of the type described above in which the depression (42) is comprised of at least one circumferential groove (44). A circumferential groove (44) is a groove which extends in a direction perpendicular to the longitudinal axis of the rotatable component (28) (page 6, lines 10-23 of the Specification). The circumferential groove(s) (44) may extend for a length shorter than, equal to, or longer than the circumference of the planar seal engagement surface (34) or the planar housing engagement surface (38), as the case may be (page 10, lines 10-15 of the Specification).

Claim 3.

Dependent Claim 3 provides a further improvement in a seal assembly (20) of the type described above in which the depression (42) is comprised of at least one circumferential groove (44) which extends for a length equal to the circumference of the planar seal engagement surface (34) or the planar housing engagement surface (38), as the case may be (page 10, lines 10-15 of the Specification).

Claim 4.

Dependent Claim 4 provides a further improvement in a seal assembly (20) of the type described above in which the depression (42) is comprised of a plurality of substantially parallel circumferential grooves (44) (page 10, lines 15-20 of the Specification).

Claim 5.

Dependent Claim 5 provides a further improvement in a seal assembly (20) of the type described above in which the depression (42) is comprised of a plurality of substantially

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parallel and concentric circumferential grooves (44) (page 10, lines 15-20 of the Specification; Figure 2).

Claim 6.

Dependent Claim 6 provides a further improvement in a seal assembly (20) of the type described above in which the depression (42) is comprised of a plurality of substantially parallel and concentric circumferential grooves (44) which each extend for a length equal to the circumference of the planar seal engagement surface (34) or the planar housing engagement surface (38), as the case may be (page 10, lines 10-20 of the Specification; Figure 2).

Claim 7.

Dependent Claim 7 provides a further improvement in a seal assembly (20) of the type described above in which the seal assembly (20) is further comprised of a preloading mechanism (52) for urging the planar seal engagement surface (34) and the planar housing engagement surface (38) into engagement with each other (page 13, lines 4-6 of the Specification).

The purpose of the preloading mechanism (52) is to provide an initial engagement force between the planar seal engagement force (34) and the planar housing engagement force (38) to inhibit the passage of fluid between the engagement surfaces (34,38) in order to enhance the isolation of the depression (42) and to permit the engagement force in the vicinity of the depression (42) to develop as the pressure applied to the seal element (22) increases while the seal assembly (20) is in service (page, 13, lines 11-18 of the Specification).

Claim 8.

Dependent Claim 8 provides a further improvement in a seal assembly (20) of the type described above in which the preloading mechanism (52) of dependent Claim 7 is comprised of at least one spring which is retained by the seal housing (24) (page 13, lines 20-25 of the Specification).

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Claim 9.

Dependent Claim 9 provides a more specific version of the improvement of independent Claim 1 in which the seal element (22) is comprised of the compressible material and the depression (42) is defined by the planar housing engagement surface (38) (page 4, lines 10-15; page 4, line 25 to page 5, line 2 of the Specification).

Claim 10.

Dependent Claim 10 provides a more specific version of the improvement of dependent Claim 9 in which the seal element (22) is comprised of a resilient compressible material (page 4, lines 17-23 of the Specification).

Claim 11.

Dependent Claim 11 is equivalent to dependent Claim 2, but is dependent upon dependent Claim 9.

Claim 12.

Dependent Claim 12 is equivalent to dependent Claim 3, but is dependent upon dependent Claim 9.

Claim 13.

Dependent Claim 13 is equivalent to dependent Claim 4, but is dependent upon dependent Claim 9.

Claim 14.

Dependent Claim 14 is equivalent to dependent Claim 5, but is dependent upon dependent Claim 9.

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Claim 15.

Dependent Claim 15 is equivalent to dependent Claim 6, but is dependent upon dependent Claim 9.

Claim 16.

Dependent Claim 16 is equivalent to dependent Claim 7, but is dependent upon dependent Claim 9.

Claim 17.

Dependent Claim 17 is equivalent to dependent Claim 8, but is dependent upon dependent Claim 16.

Claim 18.

Dependent Claim 18 provides a more specific application of the improved seal assembly (20) of independent Claim 1 in which the fluid pressure on the second side (32) of the seal assembly (20) is provided by a lubricating fluid (page 8, lines 21-27 of the Specification).

Claim 19.

Dependent Claim 19 depends from dependent Claim 18 and provides a more specific application of the improved seal assembly (20) of independent Claim 1 and dependent Claim 18 in which the seal assembly (20) is incorporated into a drilling apparatus so that the seal assembly (20) isolates the lubricating fluid on the second side (32) of the seal assembly (20) from a drilling fluid on the first side (30) of the seal assembly (20) (page 8, line 21 to page 9, line 18; page 14, line 15 to page 15, line 22 of the Specification).

Claim 20.

Dependent Claim 20 depends from dependent Claim 19 and provides a more specific application of the improved seal assembly (20) of independent Claim 1, dependent Claim 18 and dependent Claim 19 in which the drilling apparatus provides for pressure balancing so that a borehole pressure on the first side (30) of the seal assembly (20) is transmitted to the second side (32) of the seal assembly (20) so that the fluid pressure provided by the lubricating fluid on the second side (32) of the seal assembly (20) is comprised of the borehole pressure (page 14, lines 15-21 of the Specification).

6. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

In the Final Office Action dated April 4, 2006, the Examiner rejected independent Claim 1, dependent Claims 7-10, and dependent Claims 16-18 as being anticipated by U.S. Patent No. 4,729,569 (Muller et al) ("Ground 1").

In the Final Office Action dated April 4, 2006, the Examiner rejected independent Claim 1 and dependent Claims 2-17 as being unpatentable over the Specification at pages 1-2 and/or the preamble of independent Claim 1, in view of U.S. Patent No. 2,462,596 (Bent) in view of U.S. Patent No. 4,703,937 (Chrzanowski), and rejected dependent Claims 4-6 and 12-15 as being unpatentable in view of U.S. Patent No. 4,210,405 (Jesswein) ("Ground 2)".

In the Final Office Action dated April 4, 2006, the Examiner rejected dependent Claims 19-20 as being unpatentable over U.S. Patent No. 4,729,569 (Muller et al) in view of U.S. Patent No. 4,610,319 (Kalsi) ("Ground 3").

In the Final Office Action dated April 4, 2006, the Examiner also commented as follows:

(a) U.S. Patent No. 4,610,319 (Kalsi), U.S. Patent No. 6,036,192 (Dietle et al), U.S. Patent No. 6,334,619 (Dietle et al) and U.S. Patent No. 6,382,634 (Dietle et al) (the "Kalsi and Dietle references") provide additional evidence of prior art seals used in

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drilling applications having seals with planar mating surfaces ("Examiner Comment 1");

(b) U.S. Patent No. 4,729,569 (Muller et al), U.S. Patent No. 2,462,596 (Bent) and U.S. Patent No. 4,703,937 (Chrzanowski) teach that it is known to use a depression to reduce wear AND restrain movement between a seal and a housing ("Examiner Comment 2"); and

(c) U.S. Patent No. 3,830,508 (Endicott) could be modified with these teachings, with the motivation being to reduce friction against the shaft when the seal is exposed to a high fluid pressure as well as restrain movement ("Examiner Comment 3").

7. **ARGUMENT**

It is respectfully submitted that:

1. independent Claim 1 is patentable;

2. each of dependent Claims 2 - 20 is individually and separately patentable; and

3. none of Claims 1-20 stand or fall together.

(a) Ground 1

Ground 1 is an anticipation rejection based solely upon U.S. Patent No. 4,729,569 (Muller et al).

The present invention relates to a "contacting seal" in which the seal element (22) contacts the rotatable shaft (28) in order to perform the sealing function (page 1, line 12 to page 2, line 12 of the Specification).

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Muller et al relates generally to the art of "non-contacting seals", which includes hydrodynamic seals. In a non-contacting seal, the seal element does not contact the component with which it must seal. Instead, the seal is provided by a hydrostatic or hydrodynamic force between the seal element and the component.

More specifically, Muller et al relates to the art of hydrodynamic non-contacting seals (column 1, lines 5-68). In a hydrodynamic non-contacting seal, a hydrodynamic lifting force is created by relative movement between the seal element and the component with which it must seal, due to the geometry of the interface between the seal element and the component. In many hydrodynamic seals, the interface geometry is such that the face of the seal element adjacent to the component is undulating in order to enhance the hydrodynamic phenomenon at the interface.

Muller et al is therefore directed at a hydrodynamic shaft seal which is comprised of a seal ring (1 or 4) and a backup ring (3) which are fitted next to each other in a radial groove which defines a seal housing. The hydrodynamic shaft seal in Muller et al may also include a clamp ring (2) which is used to clamp the seal ring (1 or 4) and to provide a static seal in the housing.

The backup ring (3) includes projections (32) which abut the seal ring (1 or 4). Faces (31) are located between the projections (32). Under the action of a pressure "p" of the liquid acting on the seal, the seal ring (1 or 4) comes into contact with the projections (32) on the backup ring (3) and the seal ring (1 or 4) is thereby bent parallel to the axis of rotation of the shaft (5) toward the faces (31) so that the seal ring (1 or 4) assumes an undulating form.

The backup ring (3) also includes projections (34) which engage with complementary projections (6) associated with the seal housing to prevent relative twisting of the backup ring and the housing. The undulating form of the seal ring (1 or 4) results in the hydrodynamic formation of a desired lubricant film between the undulating face of the seal ring (1 or 4) and the shaft (5).

Independent Claim 1

All embodiments of Muller et al include the backup ring (3), which is of fundamental importance to the function of the seal arrangement in Muller et al and has no analogous structure in the present invention as claimed in independent Claim 1.

The Examiner has equated a face (31) on the backup ring (3) with a depression (42) on the planar seal engagement surface (34) or the planar housing engagement surface (38), as claimed in independent Claim 1. First, it is submitted that the backup ring (3) in Muller et al cannot be interpreted as either the seal element (22) or the seal housing (24) as claimed in Claim 1. Second, it is submitted that the combination of the projections (32) and the faces (31) on the backup ring (3) cannot be interpreted as a "planar" surface as claimed in Claim 1 and clearly depicted in Figures 1-3 of the Specification.

The Examiner has indicated that: "A fluid pressure "p" is exposed to the seal on the second side and causes a force that presses the material of the seal into depressions (31) in the housing thereby restraining movement of the seal relative to the housing..." It is submitted that the "depressions" referred to by the Examiner are actually faces (31) on the backup ring (3) and therefore cannot be interpreted as being associated with either a planar seal engagement surface (34) or a planar housing engagement surface (38).

In any event, the backup ring (3) in Muller et al does not provide an "isolated gap" as required by independent Claim 1, in which "The gap (48) is isolated in that the seal engagement surface effectively seals the gap (48) on **all** sides to trap low (atmospheric) pressure air in the gap while the seal assembly (20) is being assembled and to inhibit fluid from passing into the gap (48) while the seal is in service." (page 10, line 28 to page 11, line 2 of the Specification). The projections (32) and faces (31) therebetween on the backup ring (3) do not provide "an isolated gap" as claimed in independent Claim 1.

The present invention as claimed in independent Claim 1 relates to a contact seal while Muller et al relates to a non-contacting hydrodynamic seal. It is submitted that there are fundamentally different principles which guide the design of contacting and non-contacting seals, with the result that any comparisons of features of the seal arrangement of Muller et al with

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features of the seal assembly of the present invention must be made carefully having regard to these fundamentally different principles.

It is therefore respectfully submitted that independent Claim 1 is not unpatentable under Ground 1, since all of the elements of Claim 1 are not found in Muller et al either expressly or inherently.

Dependent Claims 7-8 and 16-17

The Examiner has equated the clamp ring (2) with a preloading mechanism and/or spring as claimed in dependent Claims 7-8 and 16-17. It is submitted that the purpose of the clamp ring (2) in Muller et al is to clamp the seal ring (1 or 4) and to provide a static seal in the housing (column 7, lines 43-45; column 8, lines 42-43).

As a result, it is respectfully submitted that the clamp ring (2) cannot be equated with the preloading mechanism as claimed in dependent Claims 7-8 and 16-17.

It is therefore respectfully submitted that dependent Claims 7-8 and 16-17 are not unpatentable under Ground 1 because a preloading mechanism as contemplated in dependent Claims 7-8 and 16-17 is not found in Muller et al either expressly or inherently.

Dependent Claims 9-10

It is respectfully submitted that dependent Claims 9-10 are not unpatentable under Ground 1 because independent Claim 1 is not anticipated by Muller et al.

Dependent Claim 18

It is respectfully submitted that dependent Claim 18 is not unpatentable under Ground 1 because independent Claim 1 is not anticipated by Muller et al.

(b) Ground 2

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Ground 2 is a rejection under 35 U.S.C. 103(a) based upon the Specification at pages 1-2 and/or the preamble of independent Claim 1 in view of U.S. Patent No. 2,462,596 (Bent) in view of U.S. Patent No. 4,703,937 (Chrzanowski). Ground 2 is also a rejection of dependent Claims 4-6 and 12-15 under 35 U.S.C. 103(a) in view of U.S. Patent No. 4,210,405 (Jesswein).

The preamble to independent Claim 1 indicates that the present invention relates to improvements in a contacting type seal assembly as described above under the Heading 5.: "Summary of Claimed Subject Matter".

Bent relates to a seal or packing structure: "...for use between a pair of cooperating elements which may be movable relative to each other, such as a piston and a cylinder..." (column 1, lines 1-4). The expressed object of Bent is: "...to provide a novel packing structure for use between two elements movable relative to each other, which packing structure will function under the influence of any degree of fluid pressure to prevent excessive friction between the elements and at the same time maintain a tight seal between the elements." (column 1, lines 6-23).

The seal or packing structure in Bent: "...comprises a resilient sealing ring for use in a groove of one of the aforementioned elements to establish an effective seal at all fluid pressures, at least one wall of the groove having formed therein a recess or depression into which the material of the sealing ring may flow or be displaced when the ring is compressed into the groove for operation." (column 1, lines 26-33).

In all embodiments of Bent, the recess (7) in the groove (4) is formed in a bottom or inner surface (5) of the groove (4) which inner surface (5) is oriented in a plane which is parallel to the longitudinal axis of the relatively movable element (column 2, lines 18-34; Figures 1-7). As conceded by the Examiner in the Final Office Action, there is no disclosure in Bent of a possibility of locating the recess (7) in a surface of the groove (4) which is in a plane normal to the longitudinal axis of the relatively movable element.

Chrzanowski relates to a self-venting seal assembly for relatively movable members, such as a rotating shaft (13) within a housing (12) (column 2, lines 10-18).

The purpose of the invention in Chrzanowski is to provide a mechanism for reducing the heat and frictional loads between a sealing ring (24) and the shaft (13) resulting from trapped fluid which forces the sealing ring (24) inwardly into gripping engagement with the shaft (13) (column 1, lines 35-40).

This purpose is achieved in Chrzanowski by providing for a venting of fluid from the vicinity of the outer peripheral surface of the low pressure end of the sealing ring (24) so as to prevent such fluid from forcing the inner peripheral surface of the sealing ring (24) radially inward (column 1, lines 42-47). The venting of fluid is in turn achieved by providing for a vent hole (40) for permitting fluid to escape from the vicinity of the outer peripheral surface of the low pressure end of the sealing ring (24) (column 1, lines 48-51).

In the operation of the seal assembly (10) in Chrzanowski, fluid from the high pressure end of the seal assembly (10) traverses along the outer peripheral surface of the sealing ring (24) through space (36) to the low pressure end of the seal assembly (10), where the fluid escapes through the vent hole (40). As a result, such fluid is not trapped and pressurized in the space (36) and does not force the inner periphery of the sealing ring (24) radially inward into tight gripping engagement with the shaft (13). Radial loads between the sealing ring (24) and the shaft (13) are thereby reduced, so as to reduce friction, heat and wear and to increase the service life of the seal assembly (10) (column 2, line 62 to column 3, line 3).

Although it is contemplated in Chrzanowski that the sealing ring (24) may become extruded into the vent hole (40) after the space (36) has been vented, it is also contemplated in Chrzanowski that it may be important to keep the vent hole (40) open at all times. As a result, a ring (45) of round wire may be placed in the space (36) adjacent to the vent hole (40) to facilitate venting of the space (36) while preventing the sealing ring (24) from being extruded into and closing the vent hole (40) (column 3, lines 14-30).

In any event, the primary purpose of the invention in Chrzanowski is to provide for the venting of fluid from the space (36) along the outer peripheral surface of the sealing ring (24).

Jesswein relates to means for preventing the extrusion of an elastomeric sealing member from a pivot joint which includes the elastomeric sealing member disposed between a pivot pin and a surrounding structure. The means for preventing extrusion in Jesswein include relief openings (54,58) which extend from grooves (24,26) which contain sealing members (28,30). (column 3, lines 25-36; Figures 1-3 and Figure 13).

The purpose and principles of operation of the invention in Jesswein and Chrzanowski are very similar. Referring to Figure 7 of Jesswein, as a groove (24) fills with a pressurized fluid, the outer margin (29) of the sealing member (28) collapses sufficiently to allow the fluid to pass through the relief opening (54), thus preventing extrusion of the sealing member (28) through the relief opening (54).

Jesswein contemplates a plurality of sealing members (28,30), each of which have an associated relief opening (54,58) (Figures 1-3 and Figure 13), or contemplates a plurality of equally spaced relief openings (54,55,56) associated with a single sealing member (28,30). The purpose of providing a plurality of relief openings (54,55,56) in Jesswein is to ensure that the joint will function adequately even if one relief opening (54,55,56) is obstructed.

Independent Claim 1

The purpose of the depression (42) as claimed in independent Claim 1 is to provide an isolated gap (48) between the planar seal engagement surface (34) and the planar housing engagement surface (38). The isolated gap (48) is "isolated" in that it is effectively sealed on all sides to trap low (atmospheric) pressure air in the isolated gap (48) while the seal assembly (20) is being assembled and to inhibit fluid from passing into the gap (48) while the seal is in service (page 10, line 29 to page 11, line 2 of the Specification). An isolated gap (48) is needed in order to inhibit the passage of pressurized fluid into the isolated gap (48) which may offset or neutralize the engagement force which is otherwise exerted between the planar seal engagement surface (34) and the planar housing engagement surface (38) (page 5, line 28 to page 6, line 2 of the Specification). The development of this engagement force is an essential feature of the invention (page 3, lines 4-16 of the Specification).

In summary, in independent Claim 1, the combination of the depression (42), the planar seal engagement surface (34) and the planar housing engagement surface (38) make possible the formation of the isolated gap (48) and thus the development of the engagement force between the engagement surfaces (34,38).

The recess (7) in Bent performs a completely different function than does the depression (42) in independent Claim 1. The recess (7) in Bent prevents excessive friction between the packing ring (3) and the relatively movable element. The most effective location for the groove (7) in Bent in order to perform this function is therefore in the inner surface (5), and as mentioned above, Bent does not teach or suggest placing the groove (7) in a plane which is normal to the longitudinal axis of the movable component.

The vent hole (40) in Chrzanowski also performs a completely different function than does the depression in independent Claim 1. The vent hole (40) in Chrzanowski prevents the trapping and pressurization of fluid in the space (36) between the sealing ring (24) and the housing by venting the fluid through the vent hole (40). As a result, the vent hole (40) in Chrzanowski is not analogous to the depression (42) in independent Claim 1.

The prior art seal assembly as referred to in the preamble of Claim 1 does not contemplate or suggest the use of a depression (42) providing an isolated gap (48) to develop an engagement force between the engagement surfaces (34,38) in order to maintain the seal element (22) in position relative to the seal housing (24).

Bent and Chrzanowski, separately and/or together, do not teach or suggest a planar seal engagement surface (34), a planar housing engagement surface (38), and a depression (42) which cooperate together to define an isolated gap (48).

In particular, the packing ring (3) in Bent and the sealing ring (24) in Chrzanowski do not include a planar seal engagement surface (34), but rather provide rounded seal engagement surfaces.

In addition, and as mentioned above, the groove (7) in Bent is not located in a plane which is perpendicular to the longitudinal axis of the relatively movable element.

Finally, the express purpose of the vent hole (40) in Chrzanowski is to permit the venting of high pressure fluid therethrough, which is entirely inconsistent with the purpose and requirements of the depression which provides the isolated gap (48) of independent Claim 1.

It is therefore respectfully submitted that independent Claim 1 is not unpatentable under Ground 2 because the cited references separately and/or together do not describe all of the elements of independent Claim 1 and because the cited references separately and/or together do not provide any suggestion or motivation to combine all of the elements of independent Claim 1.

Dependent Claims 2 and 11

Although Bent discloses a circumferential groove, Bent does not teach or suggest that the circumferential groove may be located in a plane which is normal to the longitudinal axis of the relatively movable element.

Chrzanowski does not teach or suggest a circumferential groove. Instead, Chrzanowski teaches a single vent hole (40) which is in no way analogous to a circumferential groove.

It is therefore respectfully submitted that dependent Claims 2 and 11 are not unpatentable under Ground 2 because the cited references separately and/or together provide no suggestion or motivation to locate the circumferential groove of dependent Claims 2 and 11 in a plane which is normal to the longitudinal axis of the rotatable element (28).

Dependent Claims 3 and 12

A circumferential groove which extends for a length equal to the circumference of the engagement surfaces (34,38) may contribute a separate sealing function to the seal assembly (20) to prevent the passage of pressurized fluid between the engagement surfaces (34,38), so that

the groove functions similar to an O-ring and provides a "seal within a seal" to further enhance the reliability of the seal assembly (20) (page 12, lines 23-28 of the Specification).

Although Bent discloses a circumferential groove which extends for a length equal to the circumference of the engagement surfaces (34,38), Bent does not teach or suggest that the circumferential groove may be located in a plane which is normal to the longitudinal axis of the relatively movable element.

Chrzanowski does not teach or suggest a circumferential groove which extends for a length equal to the circumference of the engagement surfaces (34,38). Instead, Chrzanowski teaches a single vent hole (40) which is in no way analogous to a circumferential groove which extends for a length equal to the circumference of the engagement surfaces (34,38).

In addition, the vent hole (40) in Chrzanowski could not be modified to a circumferential groove which extends for a length equal to the circumference of the engagement surfaces (34,38) without the exercise of inventive skill, since such a vent hole (40) would sever the retainer disc (27) in Chrzanowski into two pieces. Finally, such a vent hole (40) would not function as a "seal within a seal", since it would operate to vent high pressure fluid instead of to contain the high pressure fluid.

It is therefore respectfully submitted that dependent Claims 3 and 12 are not unpatentable under Ground 2 because the cited references separately and/or together provide no suggestion or motivation to locate the circumferential groove of dependent Claims 3 and 12 in a plane which is normal to the longitudinal axis of the rotatable element (28).

Dependent Claims 4-5 and 13-14

The advantage in the present invention of a plurality of depressions (42), and in particular a plurality of substantially parallel circumferential grooves as depressions (42), is that the engagement force between the engagement surfaces (34,38) may thereby be distributed over the engagement surfaces (34,38).

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Neither Bent, Chrzanowski nor Jesswein teach or suggest a plurality of substantially parallel circumferential grooves which function to distribute an engagement force between the packing ring (3) in Bent, the sealing ring (24) in Chrzanowski, or the sealing members (28,30) in Jesswein, and their adjacent housings.

Furthermore, the provision in Jesswein of a plurality of relief openings (54,55,56) is for a purpose which is very different from the purpose of providing a plurality of depressions (42) in the present invention, with the result that the teachings of Jesswein would not suggest or motivate the use of a plurality of depressions (42) in the present invention.

It is therefore respectfully submitted that dependent Claims 4-5 and 13-14 are not unpatentable under Ground 2 because the cited references separately and/or together do not describe a plurality of substantially parallel circumferential grooves in order to distribute the engagement force between the engagement surfaces (34,38) and because the cited references separately and/or together provide no suggestion or motivation to provide a plurality of substantially parallel circumferential grooves.

Dependent Claims 6 and 15

The subject matter of dependent Claims 6 and 15 combines the advantages of the features of dependent Claims 3-5 and 12-14. In other words, the configuration of the depressions (42) as claimed in dependent Claims 6 and 15 both distributes the engagement force between the engagement surfaces (34-38) and potentially provides a "seal within a seal" function.

Neither Bent, Chrzanowski nor Jesswein teach or suggest the configuration of depressions as claimed in dependent Claims 6 and 15.

It is therefore respectfully submitted that dependent Claims 6 and 15 are not unpatentable under Ground 2 because the cited references separately and/or together do not describe a plurality of substantially parallel and concentric circumferential grooves, wherein each of the grooves extends for a length equal to the circumference of the engagement surfaces (34,38). Furthermore, the cited references separately and/or together provide no suggestion or motivation to

provide a plurality of substantially parallel and concentric circumferential grooves, wherein each of the grooves extends for a length equal to the circumference of the engagement surfaces (34,38).

Dependent Claims 7-8 and 16-17

The purpose in the present invention of the preloading mechanism is to provide an initial engagement force between the engagement surfaces (34,38) to inhibit the passage of fluid between the engagement surfaces (34,38) and thus into the depression (42) (page 7, lines 6-12 of the Specification).

The Specification at page 1, line 27 to page 2, line 3 does describe the use of springs or other biasing devices to keep the sealing surface of a seal engaged with both the abutting component and with the seal housing. However, this passage in the Specification does not contemplate the use of a preloading mechanism in combination with a depression (42) and for the sole purpose of providing an initial engagement force between the engagement surfaces (34,38) to inhibit the passage of fluid between the engagement surfaces (34,38) and thus into the depression (42), as described above in the context of the purpose of the improvement defined by dependent Claims 7-8 and 16-17.

Bent does not teach or suggest any preloading mechanism for providing an initial engagement force between the engagement surfaces (34,38). In particular, the use of a preloading mechanism in Bent would appear to be contrary to the teachings of Bent, since the purpose of Bent is to counter the forces which are exerted on the packing ring (3) by reducing the engagement force between the packing ring (3) and the inner surface (5) of the groove (4).

Chrzanowski also does not teach or suggest any preloading mechanism for providing an initial engagement force between the engagement surfaces (34,38). In particular, the use of a preloading mechanism in Chrzanowski would reduce or eliminate altogether the utility of the invention in Chrzanowski, since an initial engagement force between the sealing ring (24) and the retainer (20) would increase the likelihood of the vent hole (40) being blocked or closed by the sealing ring (24), thereby preventing high pressure fluid from being vented through the vent hole (40).

It is therefore respectfully submitted that dependent Claims 7-8 and 16-17 are not unpatentable under Ground 2 because none of the cited references separately or together describe the combination of elements claimed in independent Claim 1 and any of dependent Claims 7-8 and 16-17, and because the cited references separately and/or together teach away from or provide no suggestion or motivation to arrive at the combination of elements claimed in independent Claim 1 and any of dependent Claims 7-8 and 16-17. .

Dependent Claim 9

Dependent Claim 9 depends directly from independent Claim 1 and represents a preferred configuration of the seal element (22) and the seal housing (24).

It is therefore respectfully submitted that the combined features of independent Claim 1 and dependent Claim 9 are not unpatentable under Ground 2 because none of the cited references separately or together describe the combination of elements claimed in independent Claim 1 and dependent Claim 9, and because the cited references separately and/or together provide no suggestion or motivation to arrive at the combination of elements claimed in independent Claim 1 and dependent Claim 9.

Dependent Claim 10

Dependent Claim 10 depends directly from dependent Claim 9 and represents a preferred configuration of the seal element (22) and the seal housing (24).

It is therefore respectfully submitted that the combined features of independent Claim 1 and dependent Claims 9 and 10 are not unpatentable under Ground 2 because none of the cited references separately or together describe the combination of elements claimed in independent Claim 1 and dependent Claims 9-10, and because the cited references separately and/or together provide no suggestion or motivation to arrive at the combination of elements claimed in independent Claim 1 and dependent Claims 9-10.

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(c) Ground 3

Ground 3 is a rejection under 25 U.S.C. 103(a) based upon U.S. Patent No. 4,729,569 (Muller et al) in view of U.S. Patent No. 4,610,319 (Kalsi).

As previously discussed, the present invention relates to a "contacting seal" in which the seal element (22) contacts the rotatable shaft (28) in order to perform the sealing function (page 1, line 12 to page 2, line 12 of the Specification), while Muller et al relates to the art of hydrodynamic non-contacting seals, in which the seal element does not contact the component with which it must seal.

Kalsi, like Muller et al, relates to the art of hydrodynamic non-contacting seals.

Muller et al contemplates that the hydrodynamic shaft seal described therein may be used to contain a lubricant (column 1, lines 15-25). As conceded by the Examiner, however, Muller et al does not contemplate the adaptation of the seal assembly (20) for use in a drilling apparatus.

Kalsi contemplates the specific use of a hydrodynamic seal in a rotary cone cutter type drill bit (column 1, lines 6-10; column 4, lines 55-65).

Dependent Claim 19

Dependent Claim 19 depends directly from dependent Claim 18 and indirectly from independent Claim 1 and relates to a preferred application of the present invention in a drilling apparatus.

Both Muller et al and Kalsi relate to non-contacting type seals in which the seal element does not contact the component with which it must seal.

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In a contacting type seal such as the seal assembly (20) of the present invention, the integrity of the seal depends upon the ability of the seal element (22) to maintain contact with the component with which the seal element (22) must seal.

In a non-contacting type seal, the sealing function is performed by effectively causing the seal to "fail" by allowing an amount of fluid to pass from the relatively high pressure side of the seal to the relatively low pressure side of the seal at the interface between the seal element and the component which the seal element must seal. A non-contacting type seal must therefore accommodate some amount of radial movement of the seal element relative to the component with which it must seal in order to perform its sealing function.

As a result, the principles which guide the design of contacting type seals are fundamentally inconsistent with the principles which guide the design of non-contacting type seals.

Neither Muller et al nor Kalsi teach or suggest the use of a contacting type seal in a drilling apparatus.

It is therefore respectfully submitted that dependent Claim 19 is not unpatentable under Ground 3 because Muller et al and Kalsi separately and/or together do not describe the combination of elements claimed in independent Claim 1 and dependent Claims 18-19 and because the cited references are non-analogous art and/or separately and/or together provide no suggestion or motivation to arrive at the combination of elements claimed in independent Claim 1 and dependent Claims 18-19.

Dependent Claim 20

Dependent Claim 20 depends directly from dependent Claim 19 and indirectly from dependent Claim 18 and independent Claim 1, and provides for a preferred application of the present invention in a pressure balanced drilling apparatus.

The purpose of providing for pressure balancing in the drilling apparatus, as claimed in dependent Claim 20, is to limit the differential pressure which will be experienced

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between the first side (30) and the second side (32) of the seal assembly (20). By limiting the differential pressure, the demands on the seal assembly (20) are similarly limited.

Muller et al does not teach or suggest the use of the hydrodynamic seal arrangement described therein in association with a pressure balanced drilling apparatus.

Kalsi does suggest the use of the hydrodynamic seal described therein in association with a pressure balanced drilling bit (column 14, line 65 to column 15, line 4).

However, neither Muller et al nor Kalsi, separately or together, contemplate the use of a contacting type seal in association with a pressure balanced drilling apparatus.

It is therefore respectfully submitted that dependent Claim 20 is not unpatentable under Ground 3 because Muller et al and Kalsi separately and/or together do not describe the combination of elements claimed in independent Claim 1 and dependent Claims 18-20 and because the cited references are non-analogous art and/or separately and/or together provide no suggestion or motivation to arrive at the combination of elements claimed in independent Claim 1 and dependent Claims 18-20.

(d) Examiner Comment 1

All of the Kalsi and Dietle references relate to the art of hydrodynamic non-contacting seals.

It is respectfully submitted that the Kalsi and Dietle references are non-analogous art and that none of the Kalsi and Dietle references is therefore relevant to the contacting type seal as claimed in independent Claim 1 and dependent Claims 2-20.

(e) Examiner Comment 2

Although Chrzanowski appears to contemplate locating the vent hole (40) in the sleeve member (25) so that it communicates with a plane which is parallel with the shaft (13)

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(column 3, lines 9-13), such a configuration would not teach, suggest or motivate the location of the depression (42) in the present invention, which is expressly claimed in independent Claim 1 to be located in a plane which is normal to the longitudinal axis of the rotatable component (28).

(f) Examiner Comment 3

Endicott does disclose a contacting type shaft seal (30) wherein a shaft (34) extends through the seal (30) between a first side and a second side of the seal (30), wherein a seal member (38) is retained by a housing (32), wherein one of the seal member (38) and the housing (32) is comprised of a compressible material (column 4, lines 26-28), wherein the seal member (38) is comprised of a planar seal engagement surface (64), and wherein the housing (32) is comprised of a planar housing engagement surface (54), as recited in the preamble to independent Claim 1.

However, Endicott does not teach or suggest that either of the engagement surfaces (64,54) may define a depression therein for providing an isolated gap between the engagement surfaces (64,54), nor does it provide a suggestion or motivation to include a depression in one of the engagement surfaces (64,54).

(g) Examiner Comments Generally

The Examiner indicated at page 5, lines 1-2 of the Final Office Action dated April 4, 2006 that: "The motivation is to reduce the friction against the shaft when the seal is exposed to a high fluid pressure as well as restrain movement."

It is respectfully submitted that, as discussed above, the reduction of forces acting on a seal member or seal element accurately describes the general motivation for the inventions described in each of the following references cited in the Final Office Action:

1. U.S. Patent No. 4,729,569 (Muller et al);
2. U.S. Patent No. 2,462,596 (Bent);
3. U.S. Patent No. 4,703,937 (Chrzanowski);
4. U.S. Patent No. 4,210,405 (Jesswein);

5. U.S. Patent No. 4,610,319 (Kalsi)
6. U.S. Patent No. 6,036,192 (Dietle et al)
7. U.S. Patent No. 6,334,619 (Dietle et al)
8. U.S. Patent No. 6,382,634 (Dietle et al)

The reduction of forces acting on the seal element (22) is not, however, the motivation of the present invention. Instead, the present invention is directed at providing an engagement force to counteract the forces acting on the seal element (22) while enabling the seal element (22) to maintain contact with the rotatable component (28) (page 3, lines 4-28). This engagement force is provided by the depression (42) which is defined in one of the engagement surfaces (34,38), which depression (42) provides an isolated gap (48) between the engagement surfaces (34,38).

It is therefore respectfully submitted that the above listed references cited in the Final Office Action are non-analogous art and are therefore not relevant to the patentability of Claims 1-20.

The reduction of forces acting on the seal member (38) is not the motivation for the invention described in U.S. Patent No. 3,830,508 (Endicott). However, it is respectfully submitted that the modification of Endicott using the teachings of the above listed references cited in the Final Office Action is improper because the above listed references are non-analogous art.

(h) Conclusions

For the reasons set out above, it is respectfully submitted that the Examiner's rejections of Claims 1-20 in the Final Office Action dated April 4, 2006 were erroneous and a reversal of the Examiner's decisions in the Final Office Action is respectfully requested.

More specifically, it is respectfully submitted that independent Claim 1 is patentable, and allowance of independent Claim 1 is respectfully requested.

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Dependent Claims 2-20 all depend directly or indirectly from independent Claim 1. It is further respectfully submitted that dependent Claims 2-20 are patentable on the basis of the distinctions defined therein and on the basis of the patentability of independent Claim 1. Allowance of dependent Claims 2-20 is therefore also respectfully requested.

8. CLAIMS APPENDIX

The Claims Appendix containing all of the Claims involved in this Appeal (i.e., Claims 1-20) is attached hereto and forms part of this Appellant's Brief.

9. EVIDENCE APPENDIX

No evidence is included with this Appellant's Brief.

10. RELATED PROCEEDINGS APPENDIX

There are no related proceedings, with the result that no decisions of related proceedings are included with this Appellant's Brief.

Respectfully submitted,
EMERY JAMIESON LLP

Terrence N. Kuharchuk
Reg. No. 34,999
Applicant's Agent

Dated November 1, 2006

Terrence N. Kuharchuk
Emery Jamieson LLP
1700 Oxford Tower
10235-101 Street
Edmonton, Alberta
Canada T5J 3G1
Phone: (780) 426-5220
Fax: (780) 420-6277

CLAIMS APPENDIX

1. (Previously Amended) In a seal assembly for sealing with a rotatable component so that the seal assembly defines a first side of the seal assembly and a second side of the seal assembly and so that the first side is sealed from the second side by the seal assembly, the component defining a longitudinal axis of rotation and the component extending through the seal assembly between the first side and the second side of the seal assembly extending within the seal assembly and defining a longitudinal axis of rotation, the seal assembly comprising a seal element retained within by a seal housing, wherein one of the seal element and the seal housing is comprised of a compressible material, wherein the seal element is comprised of a planar seal engagement surface, and wherein the seal housing is comprised of a planar housing engagement surface for engaging the planar seal engagement surface, the improvement comprising:

(a) one of the planar seal engagement surface and the planar housing engagement surface being comprised of the compressible material; and

(b) the other of the planar seal engagement surface and the planar housing engagement surface being oriented in a plane normal to the longitudinal axis of rotation of the component extending within the seal assembly and defining a depression therein for providing an isolated gap between the planar seal engagement surface and the planar housing engagement surface when the planar seal engagement surface and the planar housing engagement surface are engaged, for receiving the compressible material to restrain movement of the seal element relative to the seal housing; and

(c) the seal element being exposed to a fluid pressure on the second side of the seal assembly such that an engagement force is exerted between the planar seal engagement surface and the planar housing engagement surface in order to press the compressible material into the depression and thereby restrain movement of the seal element relative to the seal housing.

2. (Original) The improvement as claimed in claim 1 wherein the depression is comprised of at least one circumferential groove.

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3. (Previously Amended) The improvement as claimed in claim 1 wherein the depression is comprised of at least one circumferential groove extending for a length equal to the circumference of the other of the planar seal engagement surface and the planar housing engagement surface.

4. (Original) The improvement as claimed in claim 1 wherein the depression is comprised of a plurality of substantially parallel circumferential grooves.

5. (Original) The improvement as claimed in claim 1 wherein the depression is comprised of a plurality of substantially parallel and concentric circumferential grooves.

6. (Previously Amended) The improvement as claimed in claim 1 wherein the depression is comprised of a plurality of substantially parallel and concentric circumferential grooves, wherein each of the grooves extends for a length equal to the circumference of the other of the planar seal engagement surface and the planar housing engagement surface.

7. (Previously Amended) The improvement as claimed in claim 1, further comprising a preloading mechanism for urging the planar seal engagement surface and the planar housing engagement surface into engagement with each other.

8. (Original) The improvement as claimed in claim 7 wherein the preloading mechanism is comprised of at least one spring which is retained by the seal housing.

9. (Original) The improvement as claimed in claim 1 wherein the seal element is comprised of a compressible material and wherein the depression is defined by the housing engagement surface.

10. (Original) The improvement as claimed in claim 9 wherein the seal element is comprised of a resilient compressible material.

11. (Original) The improvement as claimed in claim 9 wherein the depression is comprised of at least one circumferential groove.

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12. (Previously Amended) The improvement as claimed in claim 9 wherein the depression is comprised of at least one circumferential groove extending for a length equal to the circumference of the planar housing engagement surface.

13. (Original) The improvement as claimed in claim 9 wherein the depression is comprised of a plurality of substantially parallel circumferential grooves.

14. (Original) The improvement as claimed in claim 9 wherein the depression is comprised of a plurality of substantially parallel and concentric circumferential grooves.

15. (Previously Amended) The improvement as claimed in claim 9 wherein the depression is comprised of a plurality of substantially parallel and concentric circumferential grooves, wherein each of the grooves extends for a length equal to the circumference of the planar housing engagement surface.

16. (Previously Amended) The improvement as claimed in claim 9, further comprising a preloading mechanism for urging the planar seal engagement surface and the planar housing engagement surface into engagement with each other.

17. (Original) The improvement as claimed in claim 16 wherein the preloading mechanism is comprised of at least one spring which is retained by the seal housing.

18. (New) The improvement as claimed in claim 1 wherein the fluid pressure on the second side of the seal assembly is provided by a lubricating fluid.

19. (New) The improvement as claimed in claim 18 wherein the seal assembly is incorporated into a drilling apparatus so that the seal assembly isolates the lubricating fluid on the second side of the seal assembly from a drilling fluid on the first side of the seal assembly.

20. (New) The improvement as claimed in claim 19 wherein the drilling apparatus provides for pressure balancing so that a borehole pressure on the first side of the seal assembly is transmitted

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to the second side of the seal assembly and so that the fluid pressure is comprised of the borehole pressure.

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EVIDENCE APPENDIX

No evidence is included with this Appellant's Brief.

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RELATED PROCEEDINGS APPENDIX

There are no related proceedings. As a result, no decisions of related proceedings are included with this Appellant's Brief.

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